

IX. *Observations on the poison of the common toad.* By JOHN DAVY, M. D. F. R. S.

Read December 22, 1825.

IN every country in which this animal is found, it is considered poisonous by the common people; and the opinion may be traced back to a very remote antiquity. Of late years the notion has been rejected by the professed naturalist, and placed in the number of vulgar prejudices. Thus, M. CUVIER speaking of the common toad, remarks: “ Ce sont des animaux d’une forme hideuse, dégoûtante, que l’on accuse mal-à-propos d’être venimeux par leur salive, leur morsure leur urine, et même par l’humeur qu’il transpirent.”

In this, as in some other instances, the common and long received opinion is well founded, and that of the philosopher hastily and erroneously formed.

The poison of the common toad, I find, is seated chiefly in the integuments, in follicles in the cutis vera, beneath the cuticle and the coloured rete mucosum. These follicles are largest and most numerous near the shoulders, and about the neck of the animal; yet they are very generally distributed, and even on the extremities. Pressure being applied to the skin, a yellowish thick fluid exudes, and occasionally spurts to a considerable distance. It may be collected with ease in sufficient quantity for examination. It possesses, I

\* Le regnè animal distribué d’après son organisation; tom. ii. p. 94. Paris, 1817.

have ascertained, the following properties. The greater part of it is soluble in alcohol and water. The aqueous solution is slightly viscid, and does not pass readily through a common philter. It is not precipitated by acetate of lead ; and its transparency is very slightly impaired by corrosive sublimate. The substance obtained by evaporation, both from the aqueous and alcoholic solution, is light yellow, and transparent ; has a faint and peculiar smell different from that of the toad, and it is slightly bitter, and very acrid, acting on the tongue like the extract of aconite prepared in vacuo, and even occasioning a smarting sensation when applied to the skin of the hand, and its effect lasts two or three hours. When heated, it readily melts, burns with a bright flame, and does not emit an ammoniacal odour. It is neither acid or alkaline, judging from its not changing the colour of litmus or turmeric paper. Caustic ammonia dissolves it ; the solution remains acrid. Nitric acid also dissolves it ; the solution is of a purple colour ; neutralized by an alkali it is less acrid, as if partially decomposed. The small portion of the fluid, not soluble either in water or alcohol, and to which it owes its consistence, is probably a variety of albumen ; and its appearance when burning would seem to warrant this idea.

Though this fluid of the toad is more acrid than the poison of the most venomous snakes, I do not find that it has any injurious, and much less fatal effect, when absorbed and carried into the circulation. A chicken punctured with a lancet dipped in it, received no injury : and in confirmation of this statement I may remark, that though, as already observed, it abounds chiefly in the integuments, it is not confined to

them ; I have detected it in a notable quantity in the bile, in a minute quantity in the viscid fluid lubricating the tongue, and also in the urine, and even in the blood.

Reflecting on the use which this fluid may be of to the toad, it has occurred to me that it may answer two purposes, and these of importance to this abhorred but innocent reptile.

As the external surface of the skin is smeared with this "sweltered venom" (the very appropriate epithet given it by our great dramatic poet), it must serve to defend it against the attacks of carnivorous animals: "a toad to eat" is a proverbial expression well known; and the facts adduced show its propriety and force. I may here add, that nature has given this animal an additional security against attack, in providing it with integuments of great thickness, and strength, and hardness; which last-mentioned quality is imparted by a layer of cutis almost analogous to bone, immediately under the rete mucosum, abounding in phosphate and carbonate of lime, and carbonate of magnesia, semi-transparent, and yet so firm that it is not easily cut.

As the fluid contains a substance which is very inflammable, and as it may be considered excrementitious, though the blood is very slightly impregnated with it, it may serve to separate a portion of carbon from the blood; and thus in its formation be auxiliary to the function of the lungs. In support of this idea, I may remark, that I find the pulmonary arteries of the toad are each divided into two branches, one of which goes to its respective lung, and the other, very little smaller, to the cutis, between the head and shoulder, on each side, and is extensively ramified where the largest

venom-follicles are situated, and where there is a plexus of veins of great size, as if intended for a reservoir of blood.

This last-mentioned peculiarity of structure, and the situation of it, corresponding to the site of the gills of the tadpole, would seem to indicate, that the sub-cutaneous distribution of the second branch of the pulmonary artery, may aid the lungs farther in their office by bringing the blood to the surface to be acted on by atmospheric air.

I have endeavoured to ascertain if there is any direct communication by spiracula through the integuments. The results I have obtained have been negative. I have introduced air through a small incision, by means of a forcing syringe, under the loose skin, also into the cavity of the abdomen, and into the lungs by the superior glottis. The air has been very much compressed under water, yet it has been completely confined, not the smallest bubble having been forced through the skin, or the lungs.

When dried, the skin of the toad exhibits two kinds of pores ; one kind, few in number, confined to the two tuberosities over the shoulders, sufficiently large to admit a hog's bristle ; the other kind, very numerous, scattered over the whole surface, and very minute. They are both of them best seen by holding the skin between the eye and a strong light ; the smallest appears as luminous points of a yellow hue ; the largest as indistinct circles. Both are covered externally with transparent cuticle, and internally by a delicate surface of cellular tissue ; some of the largest are also covered with rete mucosum ; the smallest appears to be destitute of this membrane.

Whether these apparent pores are the medium of communicating between the blood in the sub-cutaneous capillary vessels, and the atmosphere; or, whether they are merely the cutaneous apparatus of secretion and exudation, it is difficult to determine; it is not improbable that they perform both functions.

Corfu, September 15th, 1825.